

WHAT IS CLAIMED IS:

1        1. A nozzle for delivering a measured quantity of viscous liquid comprising:

2              a) an opening defined by a perimeter and a  
3              cylindrically-shaped barrel wall extending from said  
4              perimeter downward to a break point defined by a circle  
5              spaced-apart from said opening;

6              b) means for connecting said barrel wall of said  
7              nozzle to a reservoir from which a viscous liquid is  
8              transferrable to said nozzle;

9              c) a cone-shaped wall extending downward from  
10             said circular break point and then inward therefrom to a  
11             circular exit opening; and,

12             d) a straight, small-diameter exit tube, of uniform  
13             diameter, extending from said circular exit opening to a  
14             circular exit aperture for dispensing the liquid from said  
15             nozzle;

16             e) wherein there is a controlled ratio of the internal  
17             diameter of said exit tube and the wall thickness of said exit  
18             tube.

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20        2. The nozzle for delivering a measured quantity of viscous liquid of Claim 1  
21        wherein said cone-shaped wall extending downward from said circular break point and  
22        then inward therefrom to a circular exit opening has a wall convergence between about  
23        5° and about 20°.

24  
25        3. The nozzle for delivering a measured quantity of viscous liquid of Claim 1  
26        wherein said cone-shaped wall extending downward from said circular break point and  
27        then inward therefrom to a circular exit opening has a wall convergence of about 10°.

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4. The nozzle for delivering a measured quantity of viscous liquid of Claim 1  
1 wherein the ratio of the internal diameter of said exit tube to the wall thickness of said  
2 exit tube exceeds 7.5

3  
4 5. The nozzle for delivering a measured quantity of viscous liquid of Claim 1  
5 wherein said opening is circular and said horizontal perimeter is about 25 mm in  
6 diameter.

7  
8 6. A nozzle for delivering a measured quantity of viscous liquid comprising:

- 9           a) a flared opening defined by a horizontal  
10          perimeter and a flare wall extending inward from said  
11          perimeter;
- 12           b) a cylindrically-shaped barrel wall extending from  
13          said flare wall downward to a break point defined by a  
14          circle parallel to said flare opening and spaced-apart  
15          therefrom;
- 16           c) a cone-shaped wall extending downward from  
17          said circular break point and inward therefrom to a circular  
18          exit opening; and,
- 19           d) a small-diameter exit tube extending from said  
20          circular exit opening to a circular exit aperture.

21  
22 7. The nozzle for delivering a measured quantity of viscous liquid of Claim 6  
23 wherein said cone-shaped wall extending downward from said circular break point and  
24 then inward therefrom to a circular exit opening has a wall convergence between about  
25 5° and about 20°.

26  
27 8. The nozzle for delivering a measured quantity of viscous liquid of Claim 6  
28 wherein said cone-shaped wall extending downward from said circular break point and

then inward therefrom to a circular exit opening has a wall convergence of about 10°.

9. The nozzle for delivering a measured quantity of viscous liquid of Claim 6  
wherein the ratio of the internal diameter of said exit tube to the wall thickness of said  
exit tube exceeds 7.5

10. The nozzle for delivering a measured quantity of viscous liquid of Claim 6  
wherein said opening is circular and said horizontal perimeter is about 25 mm in  
diameter.

11. The nozzle for delivering a measured quantity of viscous liquid of Claim 6  
wherein said flare wall extends inward from said perimeter about 5 mm.

12. The nozzle for delivering a measured quantity of viscous liquid of Claim 6  
wherein said cylindrically-shaped barrel wall extends downward from said flare wall  
about 30 mm.

13. The nozzle for delivering a measured quantity of viscous liquid of Claim 6  
wherein said cylindrically-shaped barrel wall extends downward from said flare wall  
at an angle of about 2° with the vertical.

14. The nozzle for delivering a measured quantity of viscous liquid of Claim 6  
wherein said cone-shaped wall extends downward from said circular break point about  
40 mm.

15. The nozzle for delivering a measured quantity of viscous liquid of Claim 6  
wherein said cone-shaped wall extends downward from said circular break point at an  
angle of about 15° with the vertical.

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16. The nozzle for delivering a measured quantity of viscous liquid of Claim 6  
1 wherein said cone-shaped wall extends downward from said circular break point to a  
2 circular exit opening having an opening of about 1.5 mm.

17. A nozzle for delivering a measured quantity of viscous liquid comprising:

- 5 a) a small-diameter tube having at one first end  
6 formed by a circular exit aperture, from which the viscous  
7 liquid issues, said tube extending straight upward to a  
8 second end defining a circular entrance;
- 9 b) a cone-shaped wall extending upward from said  
10 second end defining a circular entrance and outward to a  
11 planar circular surface break point;
- 12 c) a cylindrically-shaped barrel wall extending  
13 upward from said planar circular surface break point and  
14 slightly outward to a circle lying in a plane parallel to the  
15 plane of said circular surface break point; and,
- 16 d) a flared opening defined by a horizontal  
17 perimeter and a flare wall extending outward from said  
18 circle.

19  
20 18. The nozzle for delivering a measured quantity of viscous liquid of Claim 17  
21 wherein the diameter of said small-diameter tube is constant from said first end to said  
22 second end.

23  
24 19. The nozzle for delivering a measured quantity of viscous liquid of Claim 17  
25 wherein said cone-shaped wall extends upward from said second end defining a  
26 circular entrance and outward at an angle of about 15° from the vertical to said vertical  
27 break point.

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1       20. A method of making a nozzle for delivering a measured quantity of viscous  
2 liquid into minute spaces comprising the steps of:

- 3              a) placing a small circular tablet of a malleable  
4 metal, containing a majority of copper, on a circular die  
5 having a cylindrical extended inner wall;
- 6              b) advancing a conically-shaped mandrel against  
7 said tablet and forcing the metal to be drawn down into said  
8 die and along said cylindrical extended inner wall;
- 9              c) repeating steps a) and b) using progressively  
10 smaller-diameter, conically-shaped mandrels and  
11 progressively smaller diameter-circular dies having  
12 cylindrical extended inner walls until a nozzle is formed  
13 comprising:
- 14              d) a flared opening defined by a horizontal  
15 perimeter and a flare wall extending inward from said  
16 perimeter;
- 17              e) a cylindrically-shaped barrel wall extending from  
18 said flare wall downward to a break point defined by a  
19 circle parallel to said flare opening and spaced-apart  
20 therefrom;
- 21              f) a cone-shaped wall extending downward from  
22 said circular break point and inward therefrom to a circular  
23 exit opening; and,
- 24              g) a small-diameter exit tube extending from said  
25 circular exit opening to a circular exit aperture.